Claims

What is claimed is:

1. A photocatalyst including a matrix, the matrix comprising:

a substrate; and

oxide-based nanomaterial formed on the substrate.

2. The photocatalyst as set forth in claim 1, wherein the substrate is selected from the group consisting of a silicon substrate, a glass substrate, a quartz substrate, a Pyrex substrate, a sapphire substrate, and a plastic substrate.

3. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial has a shape of a nanoneedle, nanorod, or nanotube.

4. The photocatalyst as set forth in claim 3, wherein the oxide-based nanomaterial has a multi-wall structure.

5. The photocatalyst as set forth in claim 4, wherein the oxide-based nanomaterial having the multi-wall structure has a coaxial doublewall structure including ZnO and TiO_2 as main components.

6. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial has a heterojunction structure of metal/oxide semiconductor formed by depositing metal on an oxide semiconductor nanorod.

7. The photocatalyst as set forth in claim 6, wherein the metal is deposited on the oxide semiconductor nanorod through a sputtering process or a thermal or electron beam evaporation process.

8. The photocatalyst as set forth in claim 6, wherein an oxide semiconductor comprises ZnO as a main component, and one or more metals, which are selected from the group consisting of silicide-based metals, including Ni, Pt, Pd, Au, Ag, W, Ti, Al, In, Cu, PtSi, and NiSi, is used.

9. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial is vertically oriented on the substrate.

10. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial is formed on the substrate through any one of a metal-organic chemical vapor deposition process, a sputtering process, a thermal or electron beam evaporation process, a pulse laser deposition process, a vapor-phase transport process, and a chemical synthesis process.

11. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial has a diameter from 5 to 200 nm and a length from 0.5 to 100 □.

12. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial comprises ZnO as a main component.

13. The photocatalyst as set forth in claim 12, wherein the oxide-based nanomaterial comprises one or more elements selected from the group consisting of Mg, Cd, Ti, Li, Cu, Al, Ni, Y, Ag, Mn, V, Fe, La, Ta, Nb, Ga, In, S, Se, P, As, Co, Cr, B, N, Sb, and H, as impurities, in addition to ZnO as the main component.

14. The photocatalyst as set forth in claim 12, wherein the oxide-based nanomaterial is coated with any one compound selected from the group consisting of MgO, CdO, GaN, AlN, InN, GaAs, GaP, InP, and compounds thereof.

15. The photocatalyst as set forth in claim 1, wherein the oxide-based nanomaterial comprises TiO_2 as a main component.

16. The photocatalyst as set forth in claim 15, wherein the oxide-based nanomaterial comprises one or more elements selected from the group consisting of Mg, Cd, Zn, Li, Cu, Al, Ni, Y, Ag, Mn, V, Fe, La, Ta, Nb, Ga, In, S, Se, P, As, Co, Cr, B, N, Sb, and H, as impurities, in addition to TiO_2 as the main component.

17. The photocatalyst as set forth in claim 15, wherein the oxide-based nanomaterial is coated with any one compound selected from the group consisting of MgO, CdO, GaN, AlN, InN, GaAs, GaP, InP, and compounds thereof.